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SUGAR ANALYSIS*

This is an admirable manual of sugar analysis, and will prove a great boon to everyone engaged in sugar work. The *resumé* of the chemistry of the sugars with which the book opens is of especial value to the student who wishes to get a clear idea of this complicated subject. Perhaps it had been desirable to have had the book delayed a little longer in order to have incorporated the results of the last year's study in sugar analysis, but this objection would obtain equally against any book published at any time. Another valuable feature of the book is its collection of tables referring to all conditions of sugar analysis, viz. specific gravities, solubilities, etc. The author is careful to cite authorities for his statements, and thus anyone wishing to pursue any given topic further can readily do so without being at the trouble of hunting up each theme for himself.

There is, however, a vast mass of French and German literature on certain sugar compounds which might be very appropriately drawn upon in an exhaustive study of the chemistry of sugar, and which is of no use whatever to the analyst. There is much of this in the book before us, and while it detracts nothing from its merit as a help to the analyst, it certainly adds nothing to it.

That portion of the work which is devoted to the description of the optical examination of sugars is to be highly recommended. We have, however, used for three years a Schmidt & Hänsch polariscope, and were therefore a little startled to read "ordinary lamp light, and not the monochromatic flame, is required."

We doubt very much whether, in testing the accuracy of the scale of a polariscope, quartz plates of vari-

ous thicknesses are better than solutions of pure sugar. First of all, the plates themselves would have to be tested, and this would require as much work and trouble as testing the scale directly with sugar solutions. If quartz plates could be secured which were absolutely accurate, of course this objection would not occur.

Among the sources of monochromatic light the author omitted to mention the new double burner of Laurent, which leaves nothing to be desired in the steadiness and intensity of the sodium flame.

There is one statement which the author makes in a note (p. 137) on Clerget's method of analysis that seems calculated to mislead. It is: "it must be remembered that the process is entirely inapplicable when any optically active body is present besides cane or invert sugar, and also if the invert sugar itself exists in an inactive condition as regards polarized light." In point of fact, any optically active body may be present without rendering the process inapplicable, provided it is not affected by the process of inversion. Thus, by Clerget's method we can accurately determine cane sugar in the presence of dextrose, maltose and glucose. In polarizing an inverted cane sugar, too, metal tubes should be used, since the temperature is more accurately obtained from an external thermometer than in a glass tube.

The author's directions for estimation of raw sugar and syrups are those which are generally recommended and employed. The description of these methods is full and admirably arranged. In fact, this praise can be bestowed on every part of the work. The only trouble about the methods is that if applied to the ordinary syrups of commerce they will give the most alarming errors.

The great fault of the work, in fact, is found in its failure to give reliable methods for the examination of the mixed sugars and syrups which are on the market to-day.

Perhaps, however, we should not say this is a fault of the book, it is rather a fault of science. To determine cane sugar, invert cane sugar, dextrose, dextrine, and maltose *exactly*, is a great problem which the author leaves untouched and which demands the careful attention of sugar chemists.

In papers read before the A. A. S., at the Boston and Cincinnati meetings, and published in the proceedings for the Boston meeting and in this JOURNAL, Nos. 65 and 66, Prof. Wiley has shown the relation between rotating and reducing power in commercial starch sugars and also a series of determinations of cane sugar in mixed sugars.

Since the polariscope has grown to be the chief instrument in sugar analysis and starch sugars and syrups a common article of commerce and consumption the omission of any reference to those papers is a matter to be regretted.

* Manual of Sugar Analysis, by J. H. Tucker, Ph. D., Van Nostrand, New York, 1881.

NEW YORK ACADEMY OF SCIENCES.

November 7, 1881.

REGULAR BUSINESS MEETING.

The President, Dr. J. S. Newberry, in the Chair.

Twenty-nine persons present.

A paper by Prof. P. T. Cleve, University of Upsala, Sweden, was read, by Prof. D. S. Martin, entitled

OUTLINES OF THE GEOLOGY OF THE NORTHEASTERN WEST INDIA ISLANDS.

(Abstract.)

Prof. Cleve's paper contained a resumé of his observations made during 1868-9, in and around the Virgin Islands, and published in the Swedish language in the *Trans. R. Acad. Sci.* of Stockholm, in 1871. He regards the whole group as of Cretaceous and Tertiary age, with the exception of Anegada, which, like the Bahamas, is post-pliocene.

The strike of the rocks, and the trend of the entire group, are approximately east and west. The rocks are various, largely eruptive and metamorphic. Of these, Prof. Cleve discussed somewhat fully the character and distribution of the following kinds:—1, Diorite; 2, Felsite; 3, "Blue-beach" (a peculiar volcanic breccia, locally so-called); 4, Diabase.

All these rocks have great thickness, and indicate long-continued volcanic activity. As in modern lavas, they present two types, basic and acidic.

Metamorphic slates are next described; and then a partly metamorphic limestone, occasionally with recognizable fossils, sufficient to fix the age as certainly Cretaceous.

Santa Cruz Island is then described, and referred to the same series as the Virgin group. All these islands thus indicate, by their east and west strike, and the great upturning of their rocks, that they were formed by a north and south pressure, forcing the Cretaceous and associated volcanic beds into a great line of anticlinal and synclinal folds. This period seems to have been about that of the white chalk; but the force continued to act during the succeeding Eocene time, though with diminishing intensity, as is shown by the less inclination of the Eocene beds. The Miocene strata are little disturbed, and the force would therefore seem to have spent itself by that period.

Prof. Cleve then refers briefly to the occurrence of similar metamorphic and volcanic rocks in the interior of the Great Antilles, and regards the entire series as having been formed by the same general movement of Cretaceous folding, the Virgin Islands forming the eastern extension of the line of elevation.

The Eocene strata are then taken up and discussed, as they occur in the islands of St. Martin and St. Bartholomew, just east of the Virgin group. Professor Cleve regards these islands as wholly of Eocene age, claiming that the eruptive rocks of which they mainly consist, are *interstratified* with the limestones, which contain fossils of the age of the Calcaire Grossier, of the Eocene of Paris. He then traces the occurrence of Eocene strata in Antigua, Guadeloupe, parts of Trinidad, and largely in Jamaica; and re-affirms his conclusion that the movement which raised the Great Antilles and the Virgin islands continued during the early Tertiary, though with lessening force.

The Miocene formation is then considered. It forms the small island of Anguilla, and occurs on several of the islands, south to Trinidad; but has immense development in the Great Antilles. It is chiefly a limestone series, is generally little altered from a horizontal position, and at times may be seen resting unconformably on the Eocene. By this time, evidently, the disturbing movements had ceased to make themselves felt.

The later Tertiary rocks, Pliocene and Post-pliocene,

have not been very clearly marked off from each other or from the Miocene. But to the Post-pliocene period are referred the Bahamas, Anegada, and the remarkable series of volcanic outbreaks that characterize the islands of Saba, St. Eustatius, St. Kitts, Nevis, Monserrat, Guadeloupe, &c. On St. Kitts, Prof. Cleve describes a limestone with over forty species of fossil shells, all but one of which are identified with living species of the Caribbean sea. The same is true of Anegada.

The elevation of the Miocene strata of the Great Antilles took place apparently by a "continental" uplift, whereby large areas of marine deposit were raised without folding or disturbance. Professor Cleve suggests that this movement may have been accompanied by a sinking of part of the sea-bottom in the Caribbean region to the south-east, and that on the limit between the areas of rise and of depression, fissures and faults may have occurred, through which these volcanic outbreaks of the Leeward islands found exit, in the Post-pliocene time.

DISCUSSION.

Mr. A. A. Julien confirmed the accuracy of these petrographical distinctions of the rocks of the Lesser Antilles, from the results of observation during a residence of four years on Sombroero and vicinity. The island of St. Eustatius consists mainly of volcanic ashes in a thick tabular and horizontal stratum with vertical faces along its coast. This is flanked on the south end by a volcanic cone with extinct crater, of which the bottom is occupied by a plantain plantation, but the sides are bare, and consist of a dark basaltic rock; and on the north end by two lower cones, not visited but probably volcanic. On the island of Saba the rock is light colored, rich in crystals of sanidine, and apparently a trachyte, constituting a remarkably sharp volcanic cone, with its sides deeply furrowed from top to bottom by eroded ravines; certain depressions upon the summit, resembling craters, present in some localities sulphur deposits which have been found of commercial importance.

However, the conclusion of Prof. Cleve, as to the recent age and eruptive character of most of the crystalline rocks of this region, appeared surprising in view of their metamorphic associates, and of their similarity to those of the Archæan areas identified by Hartt in Brazil. It was a question whether a nucleus of Archæan, or, at latest, metamorphic pre-Silurian rocks, in general highly tilted, does not form the axis of such islands as St. Martin, St. Barts, etc.

Prof. D. S. Martin questioned whether a corresponding movement of disturbance should not be also found in the Cretaceous strata of a region no farther removed than that of the vicinity of our own Gulf coast.

Dr. J. S. Newberry remarked that the importance of the subject of the age and origin of these crystalline rocks still demanded their re-examination and a review of Prof. Cleve's conclusions by some worker of experience in this peculiar field. One of the most interesting topographical features on this continent consisted in the line or axis of elevation marked by the Windward Islands, separating the deep basin of the Gulf of Mexico on the one side from the abyss of the Atlantic Ocean on the other. It presents a prolongation and connection of the mountain chains which run along the eastern border of the North and South American continents, in a course imperfectly parallel to that on the western border of these continents, with the gulf lying enclosed between these two great ranges. This axis has been the scene of violent volcanic action and has been supposed to mark the place of that mythical area of sunken land, styled Atlantis by the ancients. The tradition long current, recorded by Herodotus and others, points to a densely populated land west of Europe, covered with cities, and threatening the civilization of the Eastern hemisphere, which was punished by the gods by being sunk beneath the sea. According to the recent observations of an

English geologist, Mr. Thomas Belt, this legend may have had some foundation in the former existence of a continent, now submerged beneath the Caribbean sea, through which the peaks represented by the Lesser Antilles, constituted a mountain chain. Local disturbances have certainly affected this area, but we fail to find any evidence of corresponding disturbance in the Cretaceous strata of our southern States, except perhaps in continental elevations and depressions. Messrs. Guppy, Gabb, and others have studied the rocks of the region, but, up to this time, no one trained to the examination of the difficult phenomena and problems under discussion.

Nov. 14, 1881.

The President, Dr. J. S. Newberry, in the chair. Twenty-four persons present.

A paper was read by Dr. Alexis A. Julien on
THE EXCAVATION OF THE BED OF THE KAATERSKILL, N. Y.
(ABSTRACT.)

This paper was supplementary to one read before the Academy two years ago, concerning the phenomena of erosion, glaciation, etc., in the Catskill Mountains, in the vicinity of the Kaaterskill Clove.

Flexure of Strata.—Prof. James Hall has indicated the existence of four lines of flexure, running from N.E. to S.W., the synclinals occupying the summits of ranges, and Prof. Arnold Guyot locates one of these at Slide Mt. The dips at the entrance of the Clove vary from 8° to 10° to the W. N.W., becoming only 3° four miles to the westward, *i. e.*, more nearly horizontal towards a shallow synclinal fold supposed to occupy Hunter Mt.

One of the most interesting discoveries of Guyot was the linear series of three maxima of altitudes above 4000 feet, Slide Mt., Hunter Mt. and Black Dome. The gentle flexure of the whole stratum required to produce this line of maxima may be thus shown in the range running S.E. and N.W. through Hunter Mt., 35 miles long. Toward the S.E., the descent from the crest of Hunter Mt. (Alt., 4038 feet), to Overlook Mt. (3150 feet), is 888 feet, in 9½ miles, equivalent to 1 in 56, or about 1°; toward the N.W., from Hunter Mt. to Utsyanthe Mt. (3203 feet) the descent is 835 feet in 25 miles, equivalent to 1 in 158, or less than ½°.

Another similar series of maxima, however, occurs further to the westward, consisting of Graham Mt. (3886 feet), Bear-pen Mt. (3545 feet), and Ashland Pinnacle (3420 feet), distant respectively 9, 12, and 15 miles westward of the former series. This southward convergence of the axes of these two folds may probably account for the increased protuberance and greater elevations in the Southern Catskills.

Newly determined altitudes.—Many new determinations have been made of points in the vicinity of the Clove by means of an excellent aneroid, with constant reference to the numerous stations in the vicinity whose altitudes have been accurately obtained by Guyot. A few are here subjoined:

Hotel Kaaterskill, on South Mt.....	2466
Parker Hill, summit.....	2565
Parker Mt., "high ledge".....	2574
Clifton House.....	2101
Newman's ledge, on North Mt.....	2486
Gap between E. and W. peaks, North Mt.....	3116
Toll-gate on Mt. House road.....	760

Glaciation of summits.—All the crests near the Clove have been now examined. On none above an altitude of 2900 feet have glacial striæ been found, in part because they consist of thinly laminated flags deeply disintegrated by frosts. The highest striæ discovered were found on Parker Mt., "High ledge" (2874 feet), running S. 18° W. (magnetic), and under the roots of a large tree on the S.E. slope of Round Top, at an elevation of

2871 feet, running S. 35° E. However, in all cases, a marked difference exists in the slope of different sides of a peak, the E. and S.E. sides presenting a precipitous face, and the other sides more or less of a gentle slope.

The highest striæ yet found in the Catskills occur on Overlook Mt., at an elevation of about 3100 feet, implying a depth of ice in the Hudson river glacier of about or at least 3200 feet. Within the Kaaterskill basin, several miles distant from the Hudson valley, the overflowing ice stream became shallower, having an altitude of about 3000 feet. It thus appears that the surface of the glacier inclined westward over these mountains, with a slope of 200 feet in 3 miles, 1 in 84, say about ½°.

The conclusions of the former paper have been confirmed by recent observation, *viz.*, that two glacier streams have swept over these mountains, the Continental Glacier from the N. W., submerging and carving out the highest peaks, and the Hudson Valley Glacier from the N., later, more shallow, bearing along vast quantities of materials derived from the crystalline and lower Silurian rocks of the Adirondacks and of the Helderberg Mts., and strewing the whole region with their boulders; and that no local glaciers have existed in the Catskills after the retreat of the Hudson Valley Glacier.

Tilting of the Catskill plateau.—In the previous paper an explanation had been given of certain facts which seemed to indicate that the whole formation had been gently inclined to the East and then to the South-east, before assuming its present W. N. W. inclination, at a period far anterior to the Glacial epoch. A profile section of the ancient Kaaterskill valley, was exhibited, reaching from Haines' Falls nearly to the junction of the N. and S. branches of Schoharie creek, proving the gentleness of the slope, the absence of rock, and the existence of a deep and narrow buried cañon, now filled up with moraine material and a capping of peat.

A comparison of the altitudes of Prattsville (1164 ft.), a point on the Western axis, 12 miles distant from the Kaaterskill Clove, and of the lip of the stratum above Haines' Falls, (1857 ft.), at the head of the Clove, shows that a depression of the latter point below a line connecting these two points, even to the extent of a single degree, would cause a descent of nearly 700 feet from Prattsville to Haines' Falls, *i. e.*, toward the East. The excavation of the deep Kaaterskill and Plaaterkill Cloves could hardly have been effected by the small streams now occupying their beds. It is more probable that the Schoharie creek formerly flowed, at a higher level, to the east into the Kaaterskill Clove, and afterwards to the south-east into the Plaaterkill Clove, before the latest tilting of the plateau to the W. N. W. caused a reversal of the flow of the stream, in the very opposite direction, through the greater part of the same valley. An objection to this theory presented itself in the obstacle which has created a turn to the S. W. in the North branch of Schoharie creek, near its junction with the South branch. But on recent examination this was found to consist not of rock but of a huge mass of coarse moraine material deposited during the Glacial period on the southern slope of the Schoharie valley.

Sculpture of the plateau.—In a terrane consisting of strata which dip at varying and perhaps very high angles, the carving out of ranges and production of ravines and gaps may generally be assigned to the occurrence of flexures, of dykes or faults, or of beds whose material is unusually soft, fragile, or rich in minerals of easy decomposition. But the problem of topographical sculpture is less easily solved in a stratum like that of the Catskills consisting of a regular succession of layers which are horizontally homogeneous and from which the phenomena of disruption are absent. The original disintegration and erosion of the mass which resulted in the production of the ranges was perhaps mainly influenced by the direction of the jointage. With this the trend of the ranges in the vicinity of the Kaaterskill Clove appears to

coincide. The ravines, cloves, and deepest notches and valleys may be attributed to the streams of the present hydrographical basins, or to those connected with the ancient eastward and south-eastward inclination of the stratum already considered. But recent observations on the juxtaposition and coincidence of the highest gaps in successive parallel ranges may possibly indicate the remnants—in cross-section—of the beds of ancient streams at that level (about 3000 feet); this conclusion, if confirmed, would signify an inclination of the plateau to the N.N.E. (or to the S.S.W.?) at a still earlier period, that immediately succeeding its elevation.

Kames.—In the upper basin of the Kaaterskill, several isolated hills of gravel, etc., occur at an altitude of 1924 feet, especially on the bank of the stream near the head of the Clove, which are probably kames; their materials, though largely angular, show traces of imperfect stratification. Near "Blythewood," on the North branch of the Schoharie creek, a curious conical and steep isolated kame rises 102 feet above the stream, made up of rounded pebbles of the Catskill grit, rarely a foot in length, overlying a layer of coarse moraine. Its elevation above the sea (1944 feet) exceeds that of any other kame yet observed, those of the Fintry Hills in England reaching 1280 feet, and those of the Androscoggin Lakes, in Maine, 1600 feet. A very interesting series of from eight to twelve very low kames—like parallel ridges, often curving, made up of large rounded boulders—was also found to follow the course of the Kaaterskill near Palenville, in the Hudson Valley, at the mouth of the Clove, at an elevation of about 700 feet; these probably mark the course of the sub-glacial stream which issued from the mouth of the Clove. The paper concluded with observations on a deposit of laminated sand underlying the ground moraine: on the feeble erosion of the slopes of the Clove during the period which has elapsed since the close of the Glacial epoch; and on a new section of the strata of South Mountain obtained from a new road-cutting.

DISCUSSION.

Prof. E. C. H. Day observed that one portion of Dr. Julien's remarks reminded him of an idea which had struck him many years ago with regard to the surface geology of a valley on the south coast of England, near Charmouth, in Dorsetshire.

The stream in the valley referred to finds its way to the sea through a narrow pass, which, as attested by the rapid wearing of the coast line and its present configuration, could only have been of (geologically speaking) very recent origin. How the valley could have been drained prior to the existence of this outlet was a question which might be met by various hypotheses, and one of these was that there might have been a slight unequal local change of level, sufficient to have had the effect of tilting the surface of the valley so that its waters were shed then in a direction opposite to that which they now take. This was nothing more than the veriest hypothesis made many years ago, without any subsequent attempt at verification. It may suggest, however, the possibility of such slight local changes occurring, in addition to the greater movements already distinctly recognized, and the desirability of careful investigation to discover whether such may not be traced in the altered direction of streams and in the existence of ancient and unused water courses—even in our own neighborhoods. It may be added that such local tiltings of parts of the earth's crust would necessarily influence the course of subterranean as well as of subaerial waters, thus altering the distribution and force of springs at the surface.

Dr. J. S. Newberry stated that the Catskills presented a more complex bit of topography and geology, and one that had been more discussed than perhaps any other of similar area in the country. It was once supposed that these mountains were composed of a single geological formation, which, from this fact, was called the Catskill group;

and it was supposed to be a detached table land, deeply carved by erosion. The late Col. Jewett, of Albany, found strata containing Chemung fossils in the Catskills, and from this inferred that the mountains were composed of Chemung strata. Prof. Hall and Prof. Guyot, with their assistants, then made a careful study, running through several years, of the topography and geology of all the surrounding region. Their labors established the fact that the Catskills are not an isolated mountain group, but belong to the Alleghany system and are formed by a series of folds or arches composed of the Chemung and Catskill rocks. Of these folds, the convex arches, as is usually the case, were cracked and broken and, therefore, yielded readily to erosion, while the concave arches, protected and solid, yielded less readily and, in time, by the wearing away of their surroundings, were left in relief, forming ridges with a synclinal structure. Hence it will be seen that the topography of the Catskill region is chiefly the result of erosion.

So far as regards the changes of level from subterranean causes, referred to by Mr. Julien, it would certainly be strange if the foundations of the Catskills were proved to be stable. The old name, "*terra firma*," once applied to the crust of the earth, is a complete misnomer, and it is really a type of instability. Probably throughout the globe local subsidence and elevation are constantly in progress. In the interior of continents we have no evidence or measure of these, but along coast lines the water line tells us that changes are constantly and everywhere taking place, in the relative level of land and sea. About New York the coast is sinking, though very slowly, while further north, in places, it is rising, and Greenland is sinking again. Back from the coast there is no such nilometer, and yet we have no reason to suppose that the earth is more fixed. Some indication is given by the reports of those who dwell in mountainous regions, of changes of level, which have shut from their view that which was before visible or revealed what was before concealed, but these observations have not been made with accuracy and cannot be depended upon.

In a recent paper before the Academy he had shown the vast changes which had occurred along the coast in this vicinity, viz., that the land once stood 600 feet higher than at present: that the Hudson river had then flowed by the city through a channel from 300 to 500 feet deep, now in large part silted up: that the Palisades then stood from 700 to 800 feet above the river: that the Housatonic then flowed through the East river into New York Bay: that a sub-tropical climate then prevailed throughout this region, with a varied and rich fauna and flora, extending up even to the Arctic Sea: that then a depression of the temperature and great change in the climate ensued, with a corresponding alteration of the fauna and flora; but that these changes were very slow and progressive—the snows, which at first rested temporarily upon the Catskill Mountain summits, became at last permanent, and resulted in local glaciers. These glaciers produced extensive erosion, cutting the channels along which they moved, deeply. A partial obliteration of their work then ensued through two agencies. First, a continental glacier advanced southward, overtopping all the mountains, grinding down the asperities of the surface, filling old valleys, and banking up a great mass of debris along its margin—a part of which is now Long Island. Afterward the climate becoming milder, local glaciers were again formed similar to those which preceded the great Glacier, and partially obliterated or modified the results of the ancient erosion. It is a complex problem now to distinguish between the phenomena which have been respectively produced by all these glaciers in varied succession, by the erosion of streams, by flexures of the earth's crust, etc.

The excavating power of glaciers had been denied by Prof. Whitney, but ice, hundreds of feet and sometimes miles in thickness—as it was in the old glaciers—moving

with irresistible force, and having sand, gravel and boulders beneath it, or frozen into it, was the most potent agent of erosion known. The eroding power of the ancient glaciers, which once reached southward to Trenton and Cincinnati, was attested not only by the planed down rocks, but by the immense sheet of transported debris left by the glacier in its retreat.

The glaciated, planed, and polished rocks in the Western States are generally covered by a thick layer of clay, abounding in glaciated boulders. There are also other water-worn materials which have been transported, perhaps thousands of miles, representing the gravel bars, sand beds, etc., produced by sub-glacial rivers. Although the materials are entirely of glacial origin, all the stones are here usually rounded. We find in these deposits, called kames or eskers, the evidences of the action of running water produced by the melting of ice, their accumulation in heaps, ridges, etc., having been effected by local causes, waterfalls, streams upon or under the ice, etc.

The finer material produced by the same grinding action has been deposited along our coast in the vast masses of the Champlain clays. It is well known that the drainage of all glaciers results in milky streams; *e. g.*, those which descend from the Alps impart an opalescence to the Lake of Geneva, and the streams from the Cascade Mountains are clouded with silt derived from the small glaciers at their heads. So, during the Glacial period all the fine material was sometimes washed out of the glacial drift, leaving banks and ridges, kames, hogbacks, etc., of gravel and boulders, and carried by streams to the coast and there deposited along shore in the Champlain clays. The fine flour and bran ground by the glaciers have been sometimes referred to different epochs, but they are produced simultaneously. The Glacial or Champlain clays are of great economical importance to the city as they are the brick clays of Croton Point, Haverstraw Bay, and other points along the Hudson. Their thickness reaches 100 feet along the lower portion of the Hudson river, 400 feet on Lake Champlain, 500 feet at Montreal, 800 feet at Labrador, 1000 feet at Davis' Strait, and 1800 feet at Polaris Bay. This indicates that the continent was depressed to this extent at each of these points, that the waters of the ocean extended through these valleys, and that here was dead water into which the glacier drainage flowed and was deposited.

In the vicinity of New York City it is evident that the glaciers everywhere overrode and disregarded the underlying topography. All the surface of the island is strewn with materials derived from the N. N. W., and the rock has been planished and striated with grooves running in that direction. The hills back of Yonkers are covered by trap boulders which have been conveyed across the river from the Palisade range on its western side, and it is plain that the Glacier completely disregarded the depression of the Hudson valley, filled it up to a greater or less extent with *debris*, and so rode smoothly over it. Afterwards this and the other valleys were more or less cleared out by the present streams, but a portion of their contents is generally left in their beds, the tunnel between this city and Hoboken being now driven in fact through a part of this clay deposit. On the east side of the city a narrow cañon, 300 to 400 feet deep, has been proved to underlie the East River; and it would have been a wiser and cheaper plan to construct a tunnel through the clay bottom, for communication with Brooklyn, in place of the present costly and to some extent insecure bridge.

Dr. Newberry finally expressed his interest in the careful study of the erosion and sculpture of the Catskills and desire for its continuance.

MRS. J. M. FISKE has left a bequest of \$40,000, to establish a hospital for the use of the students of Cornell University.

RINGING FENCES.*

By PROF. S. W. ROBINSON, Ohio State University.

THIS sketch is mainly of a simple fact of observation. My attention was one day suddenly arrested while walking on a hard road alongside a picket fence by the peculiarity of the sound which reached my ear immediately following each step. This sound was first noticed to be very different from that perceived at other parts of the sidewalk. On instituting an inquiry for the cause of this difference the only one discoverable was a change in the construction of the yard fences along the sidewalk.

The peculiarity observed in change of sound was very marked when passing from a portion of the sidewalk opposite a board fence to parts opposite a picket fence. In the former position a quick drop of the foot upon the walk was accompanied by a simple sound or noise of short duration. But when opposite the picket fence the noise following each footstep was prolonged into a curious musical tone of initial high but rapidly lowering pitch, and with a duration of perhaps a quarter of a second.

This singular musical tone following, and due to the noise of a simple foot step, could only be accounted for on the supposition that each picket of the fence reflected the sound reaching it from the foot, the rapid succession of which, from the several pickets of the fence, resulted in the sound observed.

The duration of the sound reflected from the pickets at each step is evidently due to the different distances of the pickets from the ear of the observer, and the greater length of time required for the sound to travel to and from the more distant pickets. For instance, suppose the observer is walking along a stone or mastic walk at a distance of eight feet from the fence, the latter extending either way some distance along the street. The sharp noise of the footsteps returns from the nearest pickets first. Here the differences in distance from the adjacent pickets is slight, and hence the succession of reflected noises is rapid. But from more remote pickets the difference of distance is greater, and the succession in reflection less rapid.

In studying the nature of the resulting tone it is at once seen that the initial pitch is due to an almost infinite number of reflections or vibrations per second, while at the end of a quarter, or half, second the lines of advance and return of the sound are nearly parallel to the fence, and hence the pulsations have an interval of time equal twice the constant distance between pickets divided by the velocity of sound. For instance, if the pickets be four inches apart, or one-third of a foot, the terminal pitch would be one of about 1500 vibrations per second. The law of retrogression of pitch may be of interest. To express it as a function of passing time, let

d = distance from observer to fence.

a = constant distance between pickets.

v = velocity of sound.

n = number of vibrations per second.

t = the time following the initiation of the reflected tone.

Then by aid of a diagram we easily obtain the following relation between the above quantities, viz.:

$$\frac{v^2}{4a^2n^2} = 1 - \frac{d^2}{(vt + d)^2}$$

The curve for this equation is not easily classified. But by computing quantities and constructing a curve it is found to be very much like a hyperbola referred to its asymptotes, which indicates that the pitch falls rapidly at first, and less so subsequently.

Not only is the above described phenomenal reflection observed in connection with fences, but from any series of flat surfaces in steps, as, indeed, in the case of stairs under proper conditions. Such echoes have been observed from the steps in front of the State House, at Columbus, O.

*Read at A.A.A.S., Cincinnati.

THE AYE-AYE OR CHEIROMYS OF MADAGASCAR.

During the present year the Menagerie of the Botanical Garden has been enriched by the addition of several rare animals, and among others, by that of three Lemurs of Madagascar belonging to the strange species commonly called Aye-Aye, and scientifically *Cheiromys Madagascariensis*. The Museum of Natural History already possessed in its collection, not only the same species, obtained more than a century ago, by the explorer Sonnerat, but also several specimens preserved in alcohol or reduced to skeletons, which have been presented at more recent dates by M. de Lastelle, M. A. Grandidier and M. Meurand. The study of these different specimens and of those which the British Museum has procured, has at length led naturalists to the discovery of the true affinities of the Aye-Aye, and has decided the place it should occupy in classification, namely in the order of Lemurs. But, before coming to this conclusion, there was a great deal of hesitation and groping in the dark. Sonnerat, who discovered the Aye-Aye in Madagascar, considered it a squirrel having some connection with the Makis, soon after, Buffon found in it certain resemblances to the Tarsier, then Gmelin placed it decidedly in the genus *Sciurus* or Squirrel, under the name of *Sciurus Madagascariensis*; later still, E. Geoffroy Saint-Hilaire made a particular genus for this strange animal, namely *Daubentonia*, which G. Cuvier, agreeing with Geoffroy, afterwards changed to *Cheiromys*; finally Blainville maintained that the Aye-Aye belonged to the order of Lemurs, and he was successful, though not without difficulty, in establishing his views.

The Aye-Aye has nearly the height of a cat and resembles in a slight degree the Feline tribe in its short and globular head, erect and uncovered ears, eyes very open, nostrils oblique and pierced at the extremity of the nose, although it resembles a Squirrel in its slender toes, the color of the hair, and its bushy tail. But it differs entirely from both of these animals by the arrangement of its paws. In the Aye-Aye, indeed, the posterior limbs terminate as in the great majority of the Lemurs, in real hands, the thumb, however, being a little less developed than in the latter animals, and the anterior limbs present, at their extremities, singular anomalies. Here the thumb is no longer opposable to the other fingers and it carries, as the latter, a true claw, the middle finger is so slender that it seems withered, the fourth finger is a little less slender but still larger than the other, and finally, the little finger is very extended.

The dentition of the Aye-Aye differs in several respects from that of the other Lemurs; there are, indeed, two strong and sharp incisors in each jaw, four molars on each side of the superior maxillary and three molars only in the inferior maxillary; but no trace of canines, superior or inferior, can be seen in the adult, so that a wide space separates the incisors from the molars. Yet, this anomaly does not exist to the same degree at all periods of life, and, in the young, the dental system is least removed from the ordinary type, owing to the presence, in the superior maxillary, of a pair of small incisors.

Arrived at its full development, the Aye-Aye measures more than a metre from the end of the nose to the extremity of the tail, whose length is about equal to that of the body. It has smooth and slightly wart-like ears, uncovered nose, and lips ordinarily half open, exposing to view the incisors which, meeting two by two in a very prominent angle, resemble the beak of a parrot. Hair, bushy and very long, covers the whole of the body, the limbs and the tail, but does not present in every spot a uniform color; the hairs of the head and of the back are often white at their ends, while those of the breast and of the flanks are of a more or less brown, deepened by a yellow base. In the young, the whole front is also of a silvery white, and the dorsal line is marked by a band of the same color.

In Sonnerat's "Voyage aux Indes et à la Chine," some of the principal characteristics of the Aye-Aye are spoken of, but the portrait leaves much to be desired, and the author mentions but a few things on the habits of this curious representative of the fauna of Madagascar. This animal, says Sonnerat, appears to burrow, it does not see in the day, its eye is reddish and fixed like that of a screech-owl. It is very lazy and, consequently, very gentle. I have had the male and female and they lived only two months. I fed them with boiled rice, and they used in eating, the two slender toes of the fore-feet as the Chinese use chop-sticks. They are timid, fearful, like a great deal of heat, always roll themselves up in sleeping, lie on the side, the head between the fore-limbs. They were always lying down, and it was only on shaking them several times, that they would move at all.

Although this animal is very slow in movement, and seems to be torpid during the day, it has no relation to the *Unau* and the *Ai* of M. de Buffon. The name of Aye-Aye, which I have kept for it, is a cry of exclamation and astonishment among the inhabitants of Madagascar. This animal has been known to us but for a few years, because the western side, the part which it inhabits, is but little frequented; the inhabitants of the eastern side assured me that it was the first they had ever seen.

Fortunately, the successive observations on the *Cheiromys* at the Zoological Gardens at London and at Paris have completed the information given by Sonnerat on the manners and the diet of this species. The Aye-Aye is essentially a nocturnal animal; in captivity, it sleeps during the whole day, lying on the side, its body curled up and entirely covered by the bushy tail. During the night, on the contrary, it moves about continually, scratching and gnawing the walls of its prison. Frequently it hangs by its hind claws, and, in this position, it performs its toilet in the manner of certain Bats. In this operation it uses the third finger of the fore-feet, which it bends in the form of a hook in order to comb the tail and to adroitly wipe its front, the corners of its eyes, the nose, mouth and ears.

In eating, the Aye-Aye exclusively employs the left hand; it thrusts into the semi-liquid food which is given to it, the fourth finger, the longest of all, holding the third raised above the others, and the thumb, on the other hand, very low. The extremity of the anterior limb, thus arranged, describes a singularly rapid motion to and fro, and the lateral face of the fourth finger, passing every moment between the lips of the animal whose head is inclined on one side, places the food in the buccal cavity, over the tongue. At the same time, the cheeks and lips are in continual motion. "The Aye-Aye," says Mr. Bartlett, "can also advance its lips and lick in the manner of cats; but it does this but rarely. I have never heard it utter a single cry, emit any sound, during the long hours of night, and I never have observed that he was made uneasy by my presence. This Lemur seeks no species of insects, but readily feeds on a sort of pap made of milk, honey and eggs; it appears to love semi-fluid substances, soft and mucilaginous, while it rejects with contempt worms, grass-hoppers, and the larva of hymenopters. I have then the right to state that, in a state of nature, the Aye-Aye is not insectivorous. Seeing its strong and sharp teeth, I am inclined to believe that it cuts grooves in the bark of trees, in order to make the sap flow; it receives this in its mouth and it forms its principal nourishment. In support of this opinion, I state the fact that the animal frequently returns to the same spot on the branch or on the trunk, which it first attacked. It must also be stated that the Aye-Aye pays, so to speak, no attention to what it carries to its mouth. Having on several occasions withdrawn the dish which contained its pap, while it was eating, I saw with astonishment that it continued to direct its hand towards the spot where its food had been, and that it did not search for the latter until after having, for a long time, mechani-



THE AYE-AYE, OR CHEIROMYS OF MADAGASCAR.

cally executed prehensile motions. Such a stupid manner of acting is in complete contradiction to that which is observed among animals that devote themselves to the pursuit of other animals and feed on living prey; I presume, therefore, that the Aye-Aye feeds on vegetable substances. I have often seen it, after having swallowed a certain quantity of liquid food, devour a piece of bark."

The Cheiromys, at the Botanical Garden, given by M. Humblot and M. Archambault, act exactly like the one which has been so conscientiously studied by Mr. Bartlett, the Superintendent of the Zoological Garden of London. They sleep during the whole day, which is very annoying to the visitors desirous of seeing these strange animals, and, when the keeper tries to arouse them from their sleep, they show their ill-humor by attempting to bite and by endeavoring to retreat to the most obscure corner of their cage.

In Madagascar, the Aye-Aye inhabits the large forests, and are found not only in the western region, as Sonnerat thought, but also on the southeastern side, where it has been observed by M. Grandidier. According to the natives, it builds a real nest, of a spherical form, in which the female deposits and raises her young. This assertion without doubt merits belief, since in 1877, M. Soumagne brought to France one of these nests, which was built on the forked-head of two branches, and which contained a female and her young. The walls of this nest were formed of rolled leaves of the *Ravenala* or *Tree of the Traveler*, covering an interweaving of twigs; it has on one side a very narrow opening.

The smallest of the other Lemurs—the Chirogales, the Microcebes and the Lepilemurs—have, it appears, similar habits, and also interweave, with twigs and leaves, a home for their progeny, while the Makis, and all the higher orders of Lemurs, build no nests, and carry their young attached to their back or hung against their breast.—*Translated from La Nature.*

DETECTION OF OLEOMARGARINE.*

BY P. CASAMAJOR.

In the *Moniteur Scientifique* for April, 1881, is an article on Butter Analysis, in which are given the processes, used at the Municipal Laboratory, attached to the Prefecture of Police in Paris, for the detection of foreign fats in butter. This is followed by an account of an areometric method, used for the same purpose and based on the difference of density between butter and the fats with low melting point, extracted from tallow, which are made to resemble genuine butter, and which are known under the commercial name of *Oleomargarine*.

The sale of Oleomargarine has become so extensive in this country, that a purchaser of butter is never sure whether he is getting true butter or its imitation. In view of this fact, I have thought it useful to give a process, based on the difference of specific gravity between butter and oleomargarine, of such simplicity that it can be easily applied by any person having rudimentary ideas of manipulation.

Processes of this character are those which can be used with greatest efficiency to check adulterations. I have, in previous communications, given such processes for the detection of Starch Sugar mixed with Cane Sugar, and for the detection of starch sugar syrup, mixed with sugar house syrups.

Although my concern is principally with the difference of density between butter and oleomargarine, I propose to very briefly call attention to the processes used at the Municipal Laboratory of the Prefecture of Police, as these show important differences in chemical composition between true butter and its adulterant, which confirm the difference in the specific gravity. Such an important character as the specific gravity would not differ to any

marked extent, without a corresponding diversity in the composition of the two substances.

One process used at the Municipal Laboratory is the following: the sample of butter to be tested is melted, so as to separate water, salt etc., which are deposited, and a certain amount of scum, which comes to the surface. Of the clear melted fat, under the scum, about 3 or 4 grammes are taken and saponified by 1 or 2 grammes of potassic hydrate. The fat and potassa should be mixed with 50 C. C. of alcohol. In about 5 minutes the saponification is complete, and the cautious addition of water should not produce any turbidity. If any takes place, the operation must be begun anew. The soap formed is afterwards decomposed with weak sulphuric acid, and the insoluble fat acids are collected and weighed. The result of a great number of experiments is that in butter the percentage of fat acids thus obtained is usually 86.5 to 87.5 per cent., and that sometimes, it is as high as 88 per cent. In animal fats from tallow the percentage of insoluble fat acids is 95½. The difference 95½—87½ = 8 per cent., is attributed to the absence in tallow of volatile and soluble fat acids which exist in butter.

Another process is given in which the result is obtained volumetrically, by estimating the quantity of potassa used in saponifying the fat. One gramme of butter requires 225 to 232.4 C. C. of potassa solution, while 1 gramme of tallow, or other animal fat of the same nature, requires from 195 to 197 grammes of the same potassa solution.

Mr. Charles Girard, director of the Municipal Laboratory, considers as adulterated any butter requiring, for saponification, less than 221.5 C. C., of the potassa solution. In some unfavorable cases this volume may represent nearly 30 per cent. of foreign fat.

The method for detecting the difference between butter and oleomargarine by the difference of specific gravity, is one proposed by Messrs. Leune and Harburet.

The butter to be tested is first melted so as to separate the pure fat from water, salt, etc. The clear melted fat is placed in a cylinder, heated by the vapor escaping from a water bath, kept boiling, but no part of the cylinder is to be in the boiling water. I understand that by heating in this way, the temperature of the melted fat remains at about 93° C. To determine the density of this fat an areometer is placed in it. This areometer is graduated in such a way that, in butter, it will sink to the lowest mark of the scale, while oleomargarine corresponds to the highest point in the graduation. The intervening space is divided into ten equal parts, each one of which corresponds to 1/10 of oleomargarine, mixed with butter. More than 600 experiments made by Messrs. Leune and Harburet with artificial mixtures show that, within an approximation of ten per cent., the instrument gives correct results.

Soon after this areometric method was published, it was announced that the difference of the specific gravities of butter and of oleomargarine, was too slight to distinguish the one from the other. As Messrs. Leune and Harburet had not stated what the specific gravity of each was, it was impossible to judge of the truth of this statement, and it became interesting to ascertain the facts of the case. The following process is the result of my attempts to determine the specific gravities of butter and of oleomargarine. I chose in the first place to ascertain the specific gravity of each at 15° C, which is the usual temperature for such determinations. The process consisted in finding for each a liquid in which, at 15° C, a portion of butter or of oleomargarine, freed from impurities by previous melting and containing no air bubbles, would remain in equilibrium in any portion of the liquid, without any tendency to rise to the top or sink to the bottom. The readiest liquid for this purpose was a mixture of alcohol and water, as this is easily prepared and it has no dissolving action on the fats to be tested. As the density of the liquid in which a body remains in equilibrium is the density of the body itself, the problem was narrowed down

* (Read before the American Chemical Society Sept. 1881.)

to finding the difference of density between two mixtures of alcohol and water of different strengths. It was found that pure butter, at 15° C., would remain in equilibrium in alcohol of 53.7 per cent. This corresponds to specific gravity 0.926. This butter was obtained from a gentleman, at whose country place the butter was made. I obtained oleomargarine from melted warm beef suet by pressure. At a temperature of 25° C., this expressed fat had the consistency of butter. The alcohol which at 15° C., would hold it in equilibrium had a strength of 59.2 per cent., which corresponds to a specific gravity of 0.915.

The question of the possibility of distinguishing butter from oleomargarine becomes equivalent to the possibility of distinguishing alcohol of 53.7 per cent., from alcohol of 59.2 per cent. As this difference is 5.5 degrees of Gay Lussac's alcoholometer, it is very evident that the specific gravity is a sufficient character for distinguishing butter from oleomargarine. This difference may appear more clearly to persons not familiar with alcoholometry by stating that it is the difference between 0.926 specific gravity and 0.915.

By means of the tables of Gay Lussac and of Tralles,* it is a very easy matter to prepare alcohol of the required strength at any temperature, to be kept in bottles for future use.

As the expansion of fats is different from that of alcohol, it is advisable to bring the alcohol to 15° C., when making an observation, which can be easily done by any one provided with a thermometer.

To deliver the sample of fat on the alcohol, I have found that the best plan is to melt the fat and let a large drop of it fall into the liquid. The fat should be melted in a little spoon or a little scoop, and the drop should be delivered by bringing the spoon or scoop close to the surface of the alcohol. It requires a little practice to do this neatly, so as not to get an air bubble in the ball of melted fat. When an air bubble becomes imprisoned in the fat, I have had no difficulty in removing it with a strip of paper, while it lies on top of the alcohol. Sometimes the globule of fat only partially sinks in the alcohol; the top of it becomes flat and remains exposed above the liquid. A slight tap on the side of the glass is then generally sufficient to form a wave and sink the globule.

If we take alcohol of 56½ per cent., which represents equal volumes of alcohol of 53.7 per cent., and of 59.2 per cent., and if we deliver on the surface of this alcohol a globule of melted butter and one of oleomargarine, the butter will sink to the bottom and the oleomargarine will remain at the top, while the two globules are still warm and liquid. Afterwards, if the alcohol has a temperature of about 30° C., the butter will become solid, while the oleomargarine may still remain liquid. Then the butter will rise to the top of the alcohol, which is due to the expansion of butter on solidifying. If the alcohol be then kept for a few minutes, at 15° C., the oleomargarine will become opaque and remain at the top while the solid globule of butter will sink to the bottom.

If instead of taking alcohol of 56 per cent. we use alcohol of 59.2 per cent., oleomargarine will remain on top and butter will sink to the bottom at all temperatures above 15° C. At 15° C., oleomargarine will remain in equilibrium in portion of the liquid in which it may be placed.

If oleomargarine was always sold pure, the foregoing indications would be sufficient to distinguish it from butter, but the oleomargarine found in the market is always more or less mixed with true butter to improve its taste and appearance. This being the case, alcohol of 59 per cent. is not the proper liquid to detect oleomargarine. We should use alcohol of 55 per cent. and consider as oleomargarine any so called butter which will not sink to the bottom in alcohol of this strength at 15° C. This is founded on the fact that not more than ⅓ of butter is ever mixed with oleomargarine to improve its taste and appearance.

*See the excellent tables of Prof. Mc. Culloh.

Bearing in mind the experiments of Messrs. Leune and Harburet, already cited, the proportion of butter and of oleomargarine in a mixture could be easily detected by finding what strength of alcohol will hold in equilibrium at 15° C., a globule of fat under examination. As the difference of 59.2 and 53.7 is 5.5, the proportion of oleomargarine is the difference between the strength of the alcohol and 53.7, divided by 5.5, or more conveniently multiplied by 0.18. If the alcohol required to hold a globule of fat in equilibrium at 15° C., has a strength of 57 per cent., then: $(57 - 53.7) \times 0.18 = 3.3 \times 0.18 = 5.95$, or say $\frac{6}{10}$ of oleomargarine. If the alcohol had a strength of 58, then $58 - 53.7 \times 0.18 = 4.3 \times 0.18 = 7.72$, or about $\frac{8}{10}$ of oleomargarine.

The proportions of butter and oleomargarine in a mixture may be also determined without the aid of an alcoholometer, by using the two solutions of 53.7 per cent. and of 59.2 per cent. These may be placed in graduated glasses and poured cautiously into a third glass, until an alcohol of sufficient strength is obtained to keep in equilibrium a globule of the fat under examination at 15° C.

The relative volumes of the two solutions used in making the mixture, give the proportions of butter and oleomargarine.

The accuracy of these calculations rests entirely on the results obtained by Messrs. Leune and Harburet. I have not verified them by experiment, and I do not clearly see their utility. When we buy butter it is interesting to know whether what we buy is pure butter or not. It is no palliation to the offence of selling oleomargarine for butter that the oleomargarine contains $\frac{1}{4}$ or $\frac{1}{5}$ of real butter.

FILARIA OF THE HUMAN BLOOD.

The members of the Pathological Society, of London, recently enjoyed the rare opportunity (in this country) of seeing the filaria sanguinis hominis in the living state from a patient in the London Hospital suffering from hæmato-chyluria, under the care of Dr. Stephen Mackenzie. They were also enabled to hear from Drs. Cobbold and Vandyke Carter the facts at present known concerning filarious disease, whilst the observations related by Dr. Mackenzie, most patiently and carefully pursued for two months upon the case in question, were a valuable addition to these facts. In one important point these observations have resulted in a further discovery, to which we shall refer again. Our present purpose will be simply to gather up briefly the facts as detailed by these speakers, and to indicate their bearings upon the pathology of the obscure affections of the lymphatic system with which they are connected. In the first place we have now—thanks to the discoveries of Bancroft, Lewis, and Manson—a complete knowledge of the life history of the parasite. Like so many similar creatures, it presents us with an example of alternation of generations; or more correctly speaking, of the need of two hosts for its full development. The minute almost structureless worms found in the blood of the human subject in such vast numbers are the *embryonic* forms of the filaria which requires the mosquito in which to develop into the sexually mature worm. The mosquito feeding on the blood at night, when the filariæ are generally alone to be found, becomes gorged with them. Their growth in the mosquito has been traced by Lewis and Manson, and it is presumed that they are only liberated from the body of their host by its death in the water to which it always finally resorts. The nematoid is thus set free, and possibly undergoes further development; for the mature worm measures some three inches in length. Its passage into the human body is easily explained; and the analogy in this respect with the larger nematoid—the guinea-worm—is one which Dr. Vandyke Carter ably illustrated. Once within the human body, the worm lodges in the tissues, but as to its migrations, and, indeed, its ultimate resting-place, but little is known. It

would seem, from its discovery in a lymphatic abscess by Bancroft, and in a lymph scrotum by Lewis, to have a peculiar aptitude for selecting the lymph channels for its habitat; a selective power not more remarkable than that which urges the trichina to lodge in muscular tissue. This is further borne out by the fact that its embryos—the *filaria sanguinis hominis*—are met with in the blood and the urine of the subjects of chyluria and nævoid (or lymphatic) elephantiasis.

Now, although the various discoveries which have been made—at the expense of so much patient research and at such various times that, as Dr. Cobbold remarked at the meeting, they form each distinct “epochs”—have enabled us to form the above complete sketch of the life-history of the parasite, there are lacunæ still to be filled up. Thus knowledge is wanted upon the growth and migration of the parent worm after it has gained entrance into the human body, also as to its duration of life, and particularly as to the question whether it can take on the power of a sexual reproduction, and if so, for how long a time. The myriads of *filariae* that are probably daily reproduced in the body of such a patient as that under Dr. Mackenzie’s care seem to demand such a fact as alternate generations, and also to raise the question as to the time during which the process of reproduction can continue. There is no reason to believe that the embryonic *filariae* in the blood can undergo further development within the human body; indeed, analogy, as well as the remarkable discovery of an intermediate host in the mosquito, are opposed to this notion. Again, *filariae* have been found in the blood apart from chyluria or any outward manifestation of lymphatic derangement; but this is explicable if it be admitted that the adult worms may lodge in other parts of the body in communication with blood vessels alone. Conversely, chyluria may exist without *filaria*, and the case mentioned by Dr. Mackenzie, where the parasite was found in the man’s blood in India, but could not be found when he came to England, is explicable on the view that though the parent organism might have perished, or yielded no more embryos, yet the change excited by its presence in the lymphatic channels, and therefore the chyluria, might still have persisted.

The precise mechanism of chyluria still requires to be explained, and until it is elucidated an important part of the subject will remain obscure. The question of the pathology of chyluria was, however, barely touched upon on Tuesday, Dr. Mackenzie limiting himself to the statement of the facts observed in his case; the most important in connection with the urine being that besides having all the chylous characters, it invariably contained more or less blood,—that passed by day containing more blood and *filaria*, that passed by night being more milky; and that *filariae* were found in it, especially in connection with blood coagula. The most remarkable feature of the whole case lay in the periodicity shown by the *filariae* in their time of appearance in the blood. During the whole period of the man’s stay in the hospital his blood had been examined regularly every three hours, with the constant result that, by night, the *filariae* abounded and by day were entirely absent. From 9 A. M. to 9 P. M. they were absent; they appeared at the latter hour and increased up to midnight, then decreased till at the first-named hour none were found. These observations entirely confirmed those of Manson, and particular stress was laid upon their nocturnal wanderings and the habits of the mosquito. It is certainly singular that the time selected by the mosquito should coincide with the presence of the parasite in the blood stream, and the connection of these two facts is not the least wonderful chapter in the life-history of the parasite. But whatever the explanation of the periodicity—Dr. Vandyke Carter pointed out that it was not invariable,—a valuable addition to our knowledge of it has been made by Dr. Mackenzie. He found that whereas the time of ingestion of food bears no relation to it, it is otherwise with the

time of rest and sleep, for when the patient was up during the night and slept during the day the period of filarial migration was similarly inverted. Dr. Mackenzie did not venture to speculate upon these curious points. He wisely contented himself with laying the facts he had observed before the Pathological Society.—*Lancet*.

A VERY REMARKABLE METEOR.

On the evening of Wednesday the 16th, while sweeping the western heavens in search of comets, I was startled by a brilliant illumination to my right; looking up hastily, a bright meteor was seen moving rapidly along the north-eastern heavens. It started from a point about 3° north of Capella, and, traversing a path of about 10° , passed some 2° above *delta Aurigæ*. The flight of the meteor did not exceed three seconds, when it burst with a dazzling brilliancy, to be compared only to the whiteness of the electric light. At the moment of exploding it must have been at least five or six times brighter than Venus at her maximum. There remained in its wake—covering the full extent of its path—a thin reddish train; this drifted slowly among the stars towards the north-east, gradually collecting into a lightish cloud at its N.E. end. Noting the remarkable permanency of the train, I turned the telescope (a 5-inch refractor) upon it, and was surprised to see a very brightly glowing mass of pinkish smoke; the same material lay stretching out toward the southwest in a long, straggling strip; this trail was about one-fourth a degree in thickness, and could plainly be seen with the telescope for a distance of at least ten degrees. This mass of smoke drifted northeasterly over the stars, curling slowly, like a mighty serpent. It was knotted in several places with cumulous forms which were due probably to minor explosions in the meteor. The outlines of this wonderful train of celestial smoke were well defined; it did not diffuse itself in the atmosphere, but faded gradually from view. During the whole of its visibility it retained its pinkish color. The appearance of the meteor was at 48m. past 6. The train remained visible to the naked eye for about six minutes. In the telescope it was very distinct up to seven o’clock. At three minutes after seven it was still visible in the instrument. Meanwhile it had drifted about 4° to the north-east, becoming more crooked each moment as it curled about in the air. The remarkable duration of the train of smoke from this meteor—over fifteen minutes—deserves being recorded.

E. E. BARNARD.

NASHVILLE, Tenn., November 21, 1881.

INSTRUCTIONS ISSUED BY THE INTERNATIONAL CONFERENCE FOR THE OBSERVATION OF THE TRANSIT OF VENUS OF 1882.

Contributed by M. BENJAMIN, Ph. D.

ARTICLE I.—It is desirable, from a theoretical standpoint, that the telescopes used should be of as large aperture as possible. In practice, the difficulty of transportation on the one hand, and the necessity of observers at different stations having similar instruments, limits the apertures to from 0.12 metre to 0.15 metre (about $4\frac{1}{2}$ to 6 inches).

In all cases the objectives should be as perfect as possible. Observers should give an exact description of the quality and defects of the objective, as also the eye-piece employed. Towards this end they should determine:

1. The form of the image of a good star in focus, as also the image of the same star at a point before and after coming into focus.

2. The separating power of the objective for double stars.

It will be useful to know also if the telescope is able to show the solar granulations on any favorable opportu-

nity, and also the degree of visibility of these granulations during the transit.

ARTICLE 2.—It will be well to employ a reflecting prism, or a polariscopic eye piece, to diminish the heat and consequent danger to the observer's eyes.

If it be decided to use a silvered objective, a method which offers the great advantage of eliminating all the obscure heat rays and doing away with errors from distortion arising from heating of the interior of the tube, the excess of light may be absorbed by a neutral tint glass composed of two glasses of similar thickness, one being colored and the other colorless.

ARTICLE 3.—The eye-pieces should be positive, achromatic, and of a power of 150. The observations of contacts should be made in a field sufficiently clear to show plainly projected on the solar disc, two wires separated by a distance of 1".

Means should be employed to remove as far as possible the effects of atmospheric dispersion.

The setting point of the reticule should be previously ascertained on the stars or by means of a collimator focussed to stars.

In cases of observation by projection, correspondent means should be employed.

ARTICLE 4.—The times corresponding to internal contacts may be defined as follows:

Ingress. The moment when an evident and, at the same time, persistent discontinuity in the illumination of the apparent limb of the sun joining the point of contact with Venus, disappears.

Egress. The moment of the first appearance of an evident and, at the same time, persistent discontinuity in the illumination of the solar limb joining the point of contact.

If the limb of two stars coming into geometrical contact, without obscuration or deformation of the interposed thread of light, the instant previously defined is that of contact.

If there be produced a black drop or ligament, well defined and as dark as the body of the planet, the precedingly defined instants, are for *Ingress*, that of definite rupture, and for *Egress*, that of the first apparition of the ligament.

Between these two extreme cases, other appearances may be produced when the instants of contact may be noted as follows:

If the limbs remaining without deformation, there is produced an obscuration of the luminous thread, without the shadow, however, being as dark as the body of the planet, the observer notes the instant of geometrical contact. The moment of the formation or disappearance of this shadow should also be noted.

If the shadow is almost or becomes quite as dark as the planet, the precedingly defined instant is that when this equality ceases or is established.

The observer should also note whether there is produced on the luminous thread, any fringes or any other distinct phenomena, and should note the moment of their appearance and disappearance.

It is generally desirable to note the time of occurrence of any distinct phenomena about the time of contact. Nevertheless it is a grave mistake, and one that should be guarded against, to multiply the noting of times near the occurrence of a contact.

The time of appearance of phenomena of a distinct character, should be mentioned only in such a manner as to be readily separated from other phenomena observed about contact.

It will be useful in all cases that the observer should illustrate his notes with a drawing made immediately after each complete observation of contact, in order to show more clearly the interpretation which he attaches to his description of the phenomena.

ARTICLE 5.—As the limb of Venus falls internally on the solar disc during internal contact, as has been noted

in Article 4, the observer should indicate as closely as possible whether the moment when the limbs of Venus and the sun, apparently coinciding, seem to be lengthened out.

This observation, though rough, is still desirable as a check to the principal noted phase.

ARTICLE 6.—Notwithstanding the fact that observations of external contacts are subject to considerable uncertainty, the conference recommends that they be observed either by direct vision or by means of the spectroscope, and that the point on the solar disc, where the first contact takes place, be determined in an appropriate manner.

COMPTES RENDUS, Oct. 17, 1881, t xciii., p. 569.

BACTERIAN NOTES.

So long as the makers of microscopes do not place at our disposal much higher powers, and as far as possible without immersion, we shall find ourselves in the domain of the Bacteria, in the situation of a traveler who wanders in an unknown country at the hour of twilight, at the moment when the light of day no longer suffices to enable him clearly to distinguish objects, and when he is conscious that, notwithstanding all his precautions, he is liable to lose his way.—Cohn.

Bacteria were regarded as animals up to the time of Dujardin (1841), a kingdom—the *Protista*—midway between the animal and vegetable, being created by Haeckel for their especial benefit. Duvaine (1859) was, however, among the first to show clearly their alliance with the algæ. Cohn holds them to belong to the algæ, although from want of Chlorophyle, approaching the fungi. Magnin says, "If there are still some differences of opinion among naturalists as to the place of the Bacteria among the cryptograms, there is but one opinion of their vegetable nature." Sachs, however, solves the difficulty by uniting the algæ and fungi in a single group, the *thallophytes*, in which he establishes two series exactly parallel—one comprising the forms with chlorophyle, the other, the forms which are deprived of it."

"The Bacteria, then, resemble green plants, in that they assimilate nitrogen contained in their cells by taking it from ammonia compounds, which animals cannot do. They differ from green plants in that they cannot draw their carbon from carbonic acid, and only assimilate organic substances containing carbon, above all the hydrates of carbon and their derivatives; and in this respect they resemble animals."

Ehrenberg was the first to maintain that the motion of Bacteria depended upon the presence of vibratile cilia (observed by him in *spirillum volutans*), but although the cilia, denied at first by most microscopists, have been since seen in nearly all the bacteria, recent researches permit us to say that cilia exist without doubt in all true bacteria; the botanist who has best studied them, M. Walming for example, recognize that it is scarcely probable that these organs are the cause of their movement, for one meets some examples in which the body remains motionless, while the cilia are in violent agitation, and others in which the body moves, while the cilia remain inert or dragging behind.

Cohn explains the origin of the gelatinous substance in which the bacteria are included as being produced by a thickening or jellification of the cell membrane, but a more plausible view is that it is produced by a secretion from their protoplasm.

MR. A. AGASSIZ has printed in the *Proceedings of the American Academy* a biographical sketch of the late Count Pourtalès, together with a biographical list of his principal publications. Mr. Agassiz has also written a Review of Professor Haeckel's Monograph of the Acalephs in the August number of the *American Journal of Science*.

ATOMIC PHYLLOTAXY.

Gerber (*Chemical News*, XLIII, 242-43), says that "no simple relation exists among" his divisors, therefore they "have no value in themselves." There is, however, a relation which he failed to discover, for they are phyllotactic, as will be seen by the following comparison:

Gerber's Divisors.		Phyllotactic Divisors.	
H .9997		$H = 0 + 2^4$.998	
D ₁ .769		$\frac{1}{3} \times 2 H$.768	
D ₂ 1.995		$2 H$ 1.996	
D ₃ 1.559		$\frac{5}{2} \times \frac{5}{8} H$ 1.559	
D ₄ 1.245		$\frac{1}{2} \times \frac{1}{2} H$ 1.247	

PLINY EARLE CHASE.

HAVERFORD COLLEGE, Nov. 10, 1881.

ON September 13, 1881, a red star was noticed at the Harvard Observatory in R. A. 16th, 31. 5 m, Dec. + 72° 32'. From the similarity of its spectrum to that of several known variable stars, it was presumed to be variable; and the suspicion was confirmed both by its absence from the catalogues, and by subsequent observation, which showed that its brightness was increasing. Information respecting it was sent by telegraph to Dr. Copeland, at Strassburg, by means of the telegraphic cipher devised by Messrs. Chandler and Ritchie.

THE Museum of Comparative Zoölogy, of Harvard College, has received a collection of ninety species of fossil plants from Cannelton, Pa. The species have been identified by Mr. Lesquereux, who pronounces the series one of the best made by Mr. Mansfield from that locality.

THE annual report to the government of India on the progress of the cinchona cultivation and its practical results is a document not only of great importance, but also of considerable interest. The success which was chronicled in previous reports has been well maintained under the superintendence of Dr. King, who has the responsible charge of the cinchona cultivation in Bengal. It will be remembered that the object to which efforts hitherto have been chiefly directed is the manufacture of a cheap febrifuge from the bark of the cinchona succirubra. The plantations of this tree which are now in existence are so extensive as to suffice for present and probable requirements, so far as the febrifuge is concerned. They contain more than four millions of trees, and from them 267,335 lbs. of red bark were obtained during the year. The yield per acre (1510 lbs.) is not, however, considered to be very good; 9296 lbs. of the febrifuge were made during the year, and 8653 lbs. were consumed, 5500 lbs. being used in the Government services and 3150 lbs. sold to the public. The demand for the febrifuge steadily increases, a satisfactory proof of its value, and the total amount manufactured from the commencement to March 31, 1881, is 36,639 lbs.

Financially the enterprise, initiated with such pains by Mr. Markham, must be regarded as a complete success. The actual profit on the year's working was eight per cent. on the capital of the plantation. This does not, however, represent the whole gain of the year. The price of quinine was very high, and the cost of the 5550 lbs., which would have been used by the Government had the febrifuge not been available, would not have been less than £48,000, while the cost of the febrifuge was only a sixth of the amount, representing a saving of at least £40,000.

METEOROLOGICAL REPORT FOR NEW YORK CITY FOR THE WEEK ENDING NOV. 26, 1881.

Latitude 40° 45' 58" N.; Longitude 73° 57' 58" W.; height of instruments above the ground, 53 feet; above the sea, 97 feet; by self-recording instruments.

BAROMETER.						THERMOMETERS.										
NOVEMBER.	MEAN FOR THE DAY.	MAXIMUM.		MINIMUM.		MEAN.		MAXIMUM.				MINIMUM.				MAXIMUM
	Reduced to Freezing.	Reduced to Freezing.	Time.	Reduced to Freezing.	Time.	Dry Bulb.	Wet Bulb.	Dry Bulb.	Time.	Wet Bulb.	Time.	Dry Bulb.	Time.	Wet Bulb.	Time.	In Sun
Sunday, 20..	30.269	30.386	9 a. m.	29.798	0 a. m.	37.0	36.0	45	0 a. m.	43	0 a. m.	35	12 p. m.	35	12 p. m.	100.
Monday, 21..	30.137	30.378	0 a. m.	29.988	12 p. m.	40.0	39.0	43	3 p. m.	42	3 p. m.	35	0 a. m.	35	0 a. m.	84.
Tuesday, 22..	30.185	30.296	8 p. m.	29.982	2 a. m.	34.3	33.3	41	0 a. m.	40	0 a. m.	26	12 p. m.	26	12 p. m.	90.
Wednesday, 23..	29.941	30.280	0 a. m.	29.548	12 p. m.	30.6	30.6	35	9 p. m.	35	9 p. m.	25	3 a. m.	25	3 a. m.	45.
Thursday, 24..	29.573	29.822	12 p. m.	29.496	4 a. m.	32.0	32.0	38	12 m.	37	12 m.	25	12 p. m.	25	12 p. m.	80.
Friday, 25..	30.145	30.200	9 p. m.	29.822	0 a. m.	27.3	26.7	30	3 p. m.	30	3 p. m.	23	7 a. m.	23	7 a. m.	92.
Saturday, 26..	30.036	30.196	0 a. m.	30.000	2 p. m.	33.3	33.7	43	3 p. m.	37	4 p. m.	29	0 a. m.	28	0 a. m.	97.

Mean for the week..... 30.041 inches.
Maximum for the week at 9 a. m., Nov. 20th..... 30.386 "
Minimum " at 4 a. m., Nov. 24th..... 29.496 "
Range890 "

Mean for the week..... 34.2 degrees
Maximum for the week, at 0 a. m., 20th 45. " at 0 a. m., 20th, 43. "
Minimum " 7 a. m., 25th 23. " at 7 a. m., 25th, 23. "
Range " 22. "

WIND.						HYGROMETER.						CLOUDS.			RAIN AND *SNOW.				OZONE.
NOVEMBER.	DIRECTION.			VELOCITY IN MILES.	FORCE IN LBS. PER SQR. FEET.	FORCE OF VAPOR.			RELATIVE HUMIDITY.			CLEAR, OVERCAST.			DEPTH OF RAIN AND SNOW IN INCHES.				
	7 a. m.	2 p. m.	9 p. m.	Distance for the Day.	Max. Time.	7 a. m.	2 p. m.	9 p. m.	7 a. m.	2 p. m.	9 p. m.	7 a. m.	2 p. m.	9 p. m.	Time of Beginning.	Time of Ending.	Duration, h. m.	Amount of water.	
Sunday, 20.	n. w.	n. w.	n. e.	309	20 1.00 am	.191	.203	.204	90	82	100	6 cir. cu.	6 cir. cu.	0	----	----	----	--	
Monday, 21.	w.	w. s. w.	s. w.	135	24 1.15 pm	.212	.231	.235	100	83	91	7 cir. cu.	8 cu.	10	----	----	----	--	
Tuesday, 22.	n. w.	n. n. w.	e.	244	04 11 15 am	.216	.170	.153	90	80	100	3 cir.	3 cir. s.	0	0 am	1 am	1.00	.01	
Wednesday, 23.	n. e.	n. n. e.	n. e.	183	3 9.00 pm	.141	.174	.204	100	100	100	8 cu.	10	10	12 m	12 pm	12.00	.59	
Thursday, 24.	n. n. w.	n. n. w.	w. n. w.	275	13 3.10 pm	.188	.204	.153	100	100	100	10	8 cu.	0	0 am	5 am	5.00	.07	
Friday, 25.	w. n. w.	w. w.	w. s. w.	317	6 0.00 am	.123	.130	.160	100	78	100	0	1 cir. cu.	0	----	----	----	--	
Saturday, 26.	s. w.	w. s. w.	w. s. w.	317	7 9.15 pm	.144	.113	.147	79	42	56	2 cir.	4 cir. cu. s.	0	----	----	----	--	

Distance traveled during the week..... 1,780 miles.
Maximum force..... 20 1/2 lbs.
* Wednesday, 23d, slight.

Total amount of water for the week..... 0.67 inch.
Duration of rain..... 18 hours, 00 minutes.

DANIEL DRAPER, Ph. D.

Director Meteorological Observatory of the Department of Public Parks, New York.